

SN3262 – Network Administration, Management & Security

Diagnostic Test - **NOT ASSESSED** NAME: _____

This test covers **assumed** basic arithmetic and algebraic skills and the application of basic first year computer systems knowledge.

The whole of this test should be undertaken WITHOUT the aid of a calculator.

Write your answer to each question in the adjacent box.

Table of Powers of 2

i	2^i	i	2^i
0	1	9	512
1	2	10	1024
2	4	11	2048
3	8	12	4096
4	16	13	8192
5	32	14	16384
6	64	15	32768
7	128	16	65536
8	256	17	131072

1. Multiply out the brackets in each of the following expressions:

(a) $2(n - 3)$

(c) $n(3 - 2n)$

(b) $\frac{1}{2} \left(2n + \frac{1}{3} \right)$

(d) $(n - 1)(n + 1)$

2. Solve each of the following equations for x :

(a) $4x - 2 = 0$

(d) $3 = \frac{6}{x}$

(b) $\frac{3x}{2} + \frac{5}{2} = 0$

(e) $\frac{2}{3} = \frac{x}{x + 2}$

(c) $2x = 5 - \frac{3x}{2}$

(f) $a = \frac{b}{b + x}$

3. Write each of the following expressions as a single fraction:

(a) $\frac{2n}{3} + 1$

(c) $\frac{2n}{5} + \frac{4}{5}$

(b) $\frac{3}{4} - 2n$

(d) $\frac{n}{3} + 3 - n$

4. Rearrange each of the following expressions so that only x is on the left-hand side:

(a) $-x < 7$

(c) $2x - 5 \leq 3$

(b) $-x > -7$

(d) $\frac{x}{3} \geq \frac{1}{3}$

(c) $3x + 4 \leq 7$

5. If $a = 3 \times 10^8$, $b = 3 \times 10^3$ and a , b and c are related by $a = \frac{b}{c}$, determine c .

6. The number of **bytes** received by an interface is recorded in a 16 bit block of memory. When the block of memory is full the next byte received zeros the block and counting starts again from zero. If data is being received on the interface at the rate of 64 000 **bits** per second determine the time interval between successive zeros being stored in the memory.

7. The speed with which an “electrical” signal travels in copper wire is 2×10^8 metres per second. Determine how long it takes an “electrical” signal to travel from one end to the other of a copper wire 2000 metres long.

8. A block of memory 8 bits wide contains the hexadecimal number 42. Write down the **bit** pattern stored in the memory with the most significant bit of the block on the left.

9. Characters are often represented by 7 bit numbers and transmitted in 8 bit blocks. The following 8 bits are received on an interface, with the **least significant bit** on the left 11101010. Ignoring the **most significant bit** determine the decimal value of the number representing the character transmitted.

10. Logical (and circular shifts i.e. rotations) are quite often performed on integers in some cryptographic algorithms. A logical shift merely moves the bits to the right or left one position, and reads in a 0.

The logical shift operators in such languages as C and Python are $<<$ for logical shift left and $>>$ for logical shift right. So for example $x << y$ shifts the bits in x y positions to the left, bringing in y zeros on the right. In all of the following questions the integers are expressed in base ten.

Determine the results of the shifts on the following integers:

(a) $8 << 2$

(c) $(11 >> 2) << 2$

(b) $17 >> 3$

(d) $(11 << 2) >> 2$

11. Determine the results of the following **bitwise** binary operations using AND and XOR, where the number bases are given as subscripts, writing down your result in the base of the righthand operand:

(a) $8_{10} \text{ AND } 3_{10}$

(f) $1010_2 \text{ AND } 1001_2$

(b) $203_{10} \text{ AND } 255_{10}$

(g) $1111_2 \text{ XOR } 1001_2$

(c) $\text{FF}_{16} \text{ AND } \text{C}_{16}$

(h) $3_{10} \text{ XOR } 9_{10}$

(d) $1111_2 \text{ AND } 1001_2$

(i) $\text{FE}_{16} \text{ XOR } \text{FF}_{16}$

(e) $255_{10} \text{ AND } \text{AD}_{16}$

12. Modulo arithmetic is used in some cryptographic algorithms. Calculate the following, where mod means the remainder upon division:

(a) $3 \bmod 7$

(c) $3^2 \bmod 7$

(b) $7 \bmod 3$

(d) $7^2 \bmod 3$

13. The ***availability*** of a point to point link is the fraction of the time that the link is available. The link is either working or being repaired. If the availability of a link is 0.999 and the average time to repair the link is one hour determine the average time that the link is working before it fails (mean time between failures).